

Appl. No. 09/916,091
Amdt. Dated, November 3, 2004
Reply to Office Action of September 3, 2004

Amendments to the Claims:

This listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-10 (canceled)

Claim 11 (currently amended): In a hydraulic gear pump, adapted to be mounted in a cavity, and to pump fluid therethru comprising,

- (1) a gear housing adapted to be mounted in said cavity,
 - (2) a pair of intermeshing gears located operationally within said gear housing,
 - (3) means for rotating said gears in pumping rotation,
 - (4) first and second cover members, being located respectively on each side of the intermeshing gears and the gear housing, said cover members being located in generally flush coextensive abutment with said gear housing and said intermeshing gears, to define a predetermined path for fluid leading from an inlet to an outlet in said housing;
- the improvement;

wherein said outlet is positioned proximate said predetermined path of said pumped fluid, and the total outer surface area of said housing and cover members is greater than the interior surface area of the pump, whereby pumped fluid tends to create a pressure/force within said pump, which is transmitted to the fluid exiting said outlet and proceeding into said cavity surrounding said pump, said pressure/force being at least as great as the pressure/force of the fluid within said pump, whereby said cover members are urged against the corresponding face of the gear housing with minimal or no outside support.

Appl. No. 09/916,091

Amdt. Dated, November 3, 2004

Reply to Office Action of September 3, 2004

Claim 12 (currently amended): A hydraulic gear pump adapted to be mounted in a cavity, said cavity being adapted to contain fluid to be pumped by said pump, said pump comprising,

(1) a gear housing within the cavity and adapted to be surrounded by fluid in said cavity, and

(2) a pair of intermeshing gears located operationally within said gear housing, said intermeshing gears and gear housing having oppositely facing surfaces,

(3) first and second cover members located respectively on each side of said gear housing, in generally flush abutment with the surfaces of said gear housing and said intermeshing gears within, and one of said cover members having a fluid inlet region, and an outlet region for fluid,

(4) means for rotating said intermeshing gears in pumping rotation sufficient to move fluid therethru, but confined by said cover members, to a pre-determined path for any fluid pumped by rotation of said intermeshing gears, one of said cover members having an outlet formed therein located proximate said pre-determined path and an inlet for fluid leading to the inlet region, whereby fluid entering the pump thru the inlet is urged thru the intermeshing gears and thru the outlet, in fluid continuity, whereby the pressure developed by said intermeshing gears is propagated thru all of said fluid in the cavity whereby the hydraulic pressure is no greater inside the pump than outside the pump thereby obviating or minimizing structural support.

Claim 13 (currently amended): A hydraulic gear pump, adapted to be mounted in a surrounding cavity and to pump fluid, including said pump comprising a gear housing adapted to be located within said cavity; two cover members, one on each side of the gear housing, coaxially mounted on a common longitudinal axis; a pair of intermeshing gears in said gear housing, carried respectively by a drive shaft and an idler shaft, said drive shaft being drivingly connected to the gears and parallel to said longitudinal axis; and wherein each of the cover members is characterized by an outside axial area larger than its inside axial area, ~~on each side~~, whereby, cover members are hydraulically clamped to each side of the gear housing by the force generated by said pump in the fluid surrounding said pump in said surrounding cavity.

Appl. No. 09/916,091
Amdt. Dated, November 3, 2004
Reply to Office Action of September 3, 2004

Claim 14 (currently amended): A hydraulic gear pump, as claimed in CLAIM 13, wherein as located within a cavity, the gear housing and the cover members are surrounded by fluid having a generated pressure by reason of the rotation of said pump, whereby the pressure on the inside and the outside of the pump is essentially the same thereby equalizing the radial forces on the gear housing resulting in less stress in said gear housing.

Claim 15 (currently amended): The pump as claimed in CLAIM ~~22~~ 12, which includes a pair of appropriately spaced and secured dowel pins for locating the gear housing in registry with the two covers and being located on the suction side of the gear housing and said drive shaft and said idler shaft being parallel to the longitudinal axis of said pump to thereby minimize gear housing deflection.

Claim 16 (currently amended): The combination of,

1) ~~A~~ a pump as claimed in CLAIM ~~15~~ 12, wherein the gears are bi-rotational, and

2) ~~fluidly connected to~~ a linear motor comprising a hollow body containing a reciprocable piston and attached rod, and

3) means connecting the pump outlet and inlet to respective ends of said hollow body, said means including ~~a which extends, retracts and holds by reason of~~ a functionally located inlet check valve and an outlet check valve and a pilot actuated check valve, having an open or closed (locked) position, serving to control the direction of movement of said fluid- depending upon the position of said pilot check valve, said linear motor thereby serving to drive said reciprocal piston and rod.

Claim 17 (previously presented): ~~A pump~~ The combination as claimed in CLAIM ~~22~~ 16, wherein, 1) the hollow body is a cylinder, and 2) said pump further comprising comprises a radial seal located approximately at the longitudinal center of said pump to divide said cavity into two separate

Appl. No. 09/916,091
Amdt. Dated, November 3, 2004
Reply to Office Action of September 3, 2004

chambers, one of which is fluidly connected to one side of a piston in the hydraulic cylinder and the other one is fluidly connected to the other side of the piston of said hydraulic cylinder.

Claim 18 (currently amended): An electro hydraulic linear actuator mechanism, comprising a bi-rotational electric motor, a bi-rotational hydraulic pump, a linear, hollow body, having two capped ends, and a rod and attached piston in said hollow body located and adapted for movement of said rod and piston in said hollow body responsive to fluid pressure applied proximate either end of said hollow body, said bi-rotational pump including intermeshing gears carried by and driven by a drive shaft located in a housing, said bi-rotational electric motor for drivingly or rotating in a first direction and an opposing second direction of rotation and including a pair of pressure clamped cover members on each side of the housing, said pump being adapted to pump fluid, and means for directing said fluid to either end of said linear hollow body.

Claim 19 (currently amended) An electro hydraulic linear actuator as claimed in CLAIM 18 wherein the bi-rotational hydraulic pump is located at inside one end of the linear, hollow, hydraulic body.

Claim 20 (previously presented) An electro hydraulic linear actuator as claimed in CLAIM 19 wherein the end cap and the rod end cap are connected by the same cylindrical structural member embracing all of the components thereof.

Claim 21 (currently amended): A pump as claimed in CLAIM 14 15 which includes two or more appropriately spaced and secured dowel pins means and corresponding means for receiving said dowel pins, all for improving the location and orientation of the gear housing relative to the covers and the gears.

Appl. No. 09/916,091

Amdt. Dated, November 3, 2004

Reply to Office Action of September 3, 2004

Claim 22 (currently amended) The pump as claimed in CLAIM 11, wherein the gear housing and the cover members are located in said cavity and thereby surrounded by the pump's generated pressure/force within the cavity whereby the pressure/force on the inside and outside are essentially the same.

Claim 23 (currently amended) An electro hydraulic, linear, actuator mechanism, comprising a bi-rotational electric motor, a bi-rotational hydraulic pump as in CLAIM 22 18 fluidly connected to a hydraulic cylinder, said pump being inclusive of a fluid reservoir concentrically located with respect to and surrounding said hydraulic pump, said pump having no connection to the outside atmosphere, said assembly defining an interior volume half of which is occupied by fluid and the rest air or other inert gas.

Claim 24 (currently amended): An electric hydraulic actuator as in CLAIM 23 wherein the said hydraulic cylinder includes capped ends ~~are~~ secured to the cylindrical structural member by means of crimping same into grooves in the end caps.

Claim 25 (currently amended) An electro hydraulic actuator as in CLAIM 24 23 wherein the bi-rotational electric motor, the drive shaft of the said bi-rotational pump and the hollow hydraulic body are located generally concentric to each other.

Claim 26 (currently amended) The pump as claimed in CLAIM 13 fitted in said cavity located in one end of a hollow body, said pump having an inlet port and two outlet ports and an electric motor drivingly connected to the pump, said pump and said motor being generally concentric to said hollow body.

Claim 27 (currently amended) A hydraulic gear pump as claimed in Claim 13 which additionally includes two end cap members, one on each

Appl. No. 09/916,091

Amdt. Dated, November 3, 2004

Reply to Office Action of September 3, 2004

side of the cover members, and being in flush relationship therewith, and concentric therewith, said end cap members each having facing surfaces which are machined to be compatible with the adjacent facing surfaces of the cover members to define internal passageways and voids for ball valves.

Claim 28 (currently amended) The improved gear pump as claimed in Claim ~~14~~ 27, wherein said internal passageways are machined to contain a plurality of ball check valve means, constructed and arranged to control or direct fluid to one or the other of said outlets, depending upon the direction of rotation of movement of said intermeshing gears in clockwise (cw) or counterclockwise (ccw) rotation and said cavity ~~means~~ enclosing said bi-rotational pump such that the pump parts are surrounded by the fluid being pumped, said fluid exhibiting the pressure developed by the pump itself.

Claim 29 (canceled)

Claim 30 (currently amended): A pump as claimed in Claim 13 wherein the gear housing and the first and second cover members are is surrounded by a fluid within the cavity, said fluid having-generated pressure generated by the rotation of the pump, wherein the pressure outside the pump is at least equal to the pressure on the inside of the pump resulting in less stress inside said gear housing.

Claim 31 (previously presented) In combination

- 1) an elongate hollow body including a piston and piston rod arranged for reciprocal movement within said hollow body responsive to fluid pressure introduced at either end through appropriate openings in said end;
- 2) a bi-rotational pump adapted to pump fluid, said pump including a gear housing, cover members on each side of said housing, a drive shaft and idler shaft mounted in spaced parallel relationship, a pair of intermeshing gears carried respectively by said drive shaft and said idler shaft;
- 3) a reversible electric motor;
- 4) a switch for controlling the direction of rotation of said electric motor;

Appl. No. 09/916,091

Amdt. Dated, November 3, 2004

Reply to Office Action of September 3, 2004

5) a gearless means for connecting said electric motor to to said drive shaft whereby the direction of rotation of said intermeshing rotating gears depends on the rotation of said drive shaft either clockwise or counterclockwise; said pump further including an inlet means for introducing fluid to the interior of said pump and directing same to a mesh of the intermeshing gears and a first outlet connected to one of said openings at one end of said hollow body and a second outlet means connected to the other opening at the other end of said hollow body and means for directing fluid pumped to one outlet or the other depending on the direction of said drive means and said intermeshing gears.

Claim 32 (previously presented) An improved bi-rotational gear pump generally comprising a generally circular or annular gear housing defining a central cavity; adapted and sized to receive a pair of intermeshing gears carried axially by drive means, capable of rotating in a "cw" or "cww" direction and thereby capable of pumping liquid through said pump depending upon the rotation of said drive means, a pair of generally circular cover members situated concentrically in flush abutment, on either side of said gear housing, a pair of generally circular end-cap members in concentric flush abutment on either side of said cover members; said cover members and said end cap members each being machined so as to define together a plurality of interconnected, internal passageways, an inlet means for fluid leading to said pair of intermeshing gears, and two outlet means for pumped fluid and means for directing said fluid to one or other of said outlet means depending on the direction of rotation of said intermeshing gears.

Claim 33 (previously presented) The invention as claimed in Claim 32 wherein the series of connected internal passageways includes an array of ball valves which are constructed and arranged to open or close depending upon the rotational movement of the intermeshing gears and consequent movement of the fluid.

Claim 34 (previously presented) The invention as claimed in Claim 33 and further comprising a plurality of valves located within said connected internal passageways and means for controlling said ball valves as to change the movement of said fluid through internal passageways.

Appl. No. 09/916,091
Amdt. Dated, November 3, 2004
Reply to Office Action of September 3, 2004

Claim 35 (previously presented) The invention as claimed in Claim 34 and further comprising a pilot type piston located in at least one of the valves serving to open or close the valve in question.

Claim 36 (currently amended) The improved hydraulic gear pump as claimed in Claim 11, wherein the flush surfaces of said cover members are machined to define internal passageways for the pumped fluid to control or direct said fluid on said predetermined path.